Environmental Protection Agency

Office of Transportation and Air Quality
National Vehicle and Fuel Emissions Laboratory
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Hydraulic Testing Pressure Transducer Calibration Procedure

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NVFEL Reference Number

046

Implementation Approval

Original Procedure Authorized by EPCN #303 on 2-25-2002

Revision Description

Table of Contents

1. Purpose

The purpose of this working procedure is to describe the steps required to perform and document the calibration of pressure transducers in the PNGV hydraulic test cells. The test articles used:

Ametek Model R5 Comparator and Deadweight Pressure Determination System
Ametek Model R-100-1 Comparator and Deadweight Pressure Determination System
Calibration weights

2. Test Procedure

101 Bring the pressure determination system into the test cell. Position it near the pressure transducer to be calibrated.

102 Ensure that the pressure determination system is level using a level and shims, if necessary. See Figure 1.

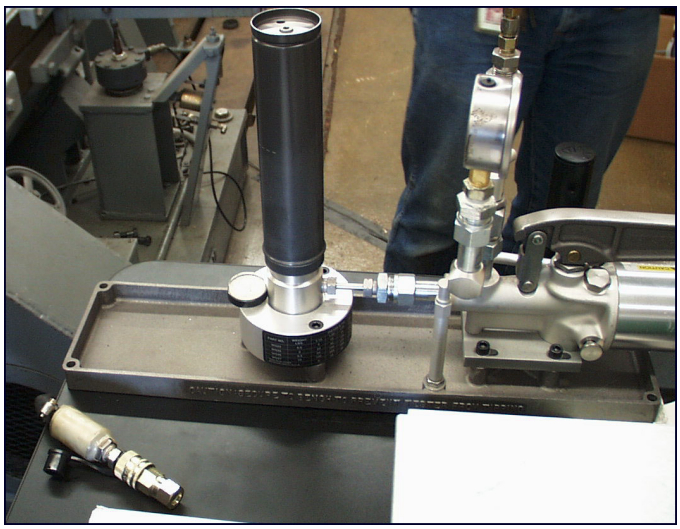

Figure 1
Level the Pressure Determination System

103 Obtain the Dead-weight Pressure Calibrations form for the pressure transducer to be calibrated:

Dead-weight Pressure Calibrations, 200 psi Pressure Transducers, see Attachment A

Dead-weight Pressure Calibrations, 500 psi Pressure Transducers, see Attachment B

Dead-weight Pressure Calibrations, 1000 psi Pressure Transducers, see Attachment C

Dead-weight Pressure Calibrations, 5000 psi Pressure Transducers, see Attachment D

104 Enter the following information in the designated space:

Transducer serial number (S/N)

Location

Date

105 Disconnect the pressure transducer to be calibrated from the pump/motor fixture and attach the quick-disconnect snap fitting. This will prepare the pressure transducer for an open atmosphere reading. See Figure 2.

Figure 2
Attach Snap Fitting

106 In the control room, turn on the Micron Computer, if necessary. Log on by simultaneously depressing <ctrl>, <alt> and <Delete>. Enter the password, if necessary and select "OK."

107 On the computer desktop, select the "Cell 4 DAQ" icon. See Figure 3. Wait for the LabView program to load. The "Cell 4 Task Master(doc)vi" will open.

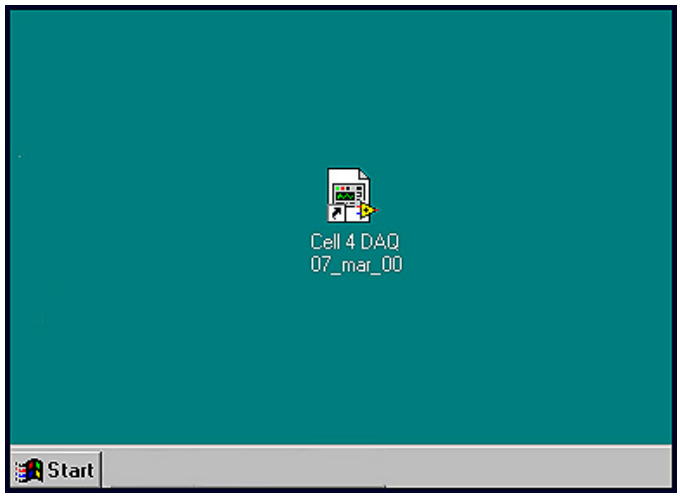

Figure 3
Select Cell 4 DAQ

108 On the "Cell 4 Task Master(doc)vi" screen, use the mouse to select the blue "Mode Selector" button (see Figure 4a) to change its color from blue (see Figure 4a) to red (See figure 4b), if the mode selector is blue.

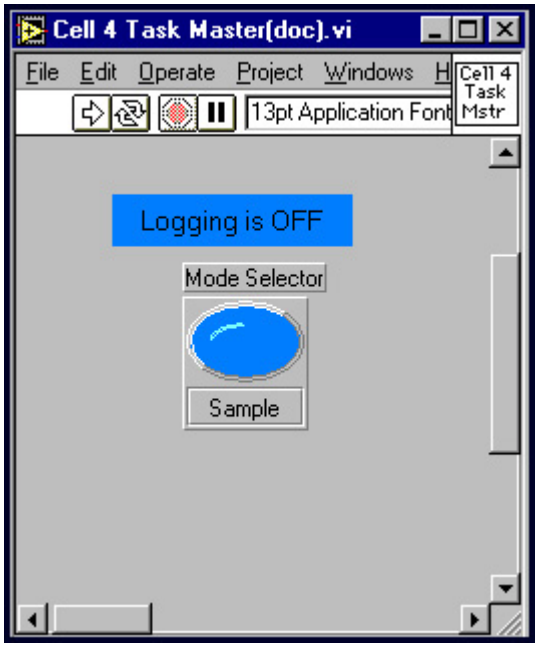

Figure 4a
Mode Selector Sample

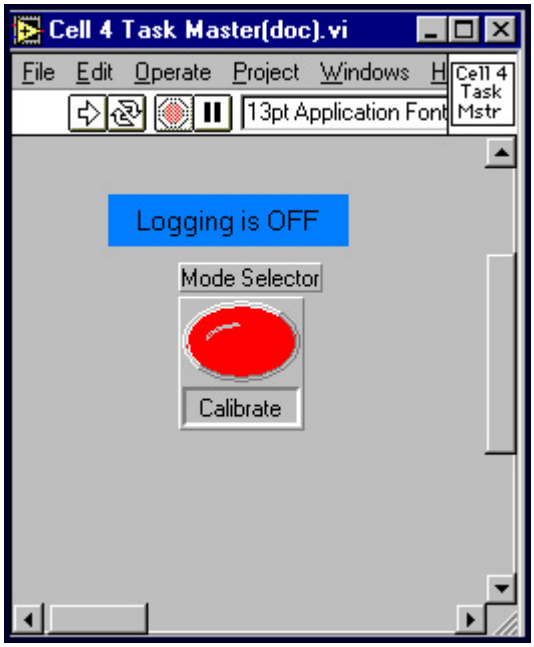

Figure 4b
Mode Selector Calibrate

109 Select “Single Run.” See Figure 5.

Figure 5
Single Run

110 On the “Configuration Array” screen, select the up or down arrow for the device “Channel Cluster.” See Arrow 1 in Figure 6.

Select the up or down arrow for the device “Channel Name.” See Arrow 2 in Figure 6.

Select “Done.” See Arrow 3 in Figure 6.

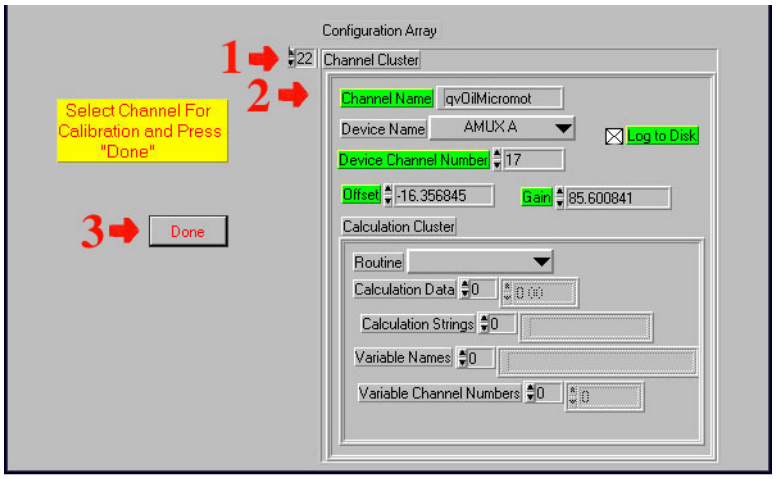

Figure 6
Device Channel Number

111 On the “Enter number of calibration points and the first point engineering value” screen, select the up or down arrow to obtain “2” under “Number of Calibration Points.” See Arrow 1 in Figure 7.

Use the keyboard to enter the value, “0.00” under “Point 1 in Engineering Units (EU).” See Arrow 2 in Figure 7.

Select “OK.” See Arrow 3 in Figure 7. The system is set to perform a Zero/Span calibration.

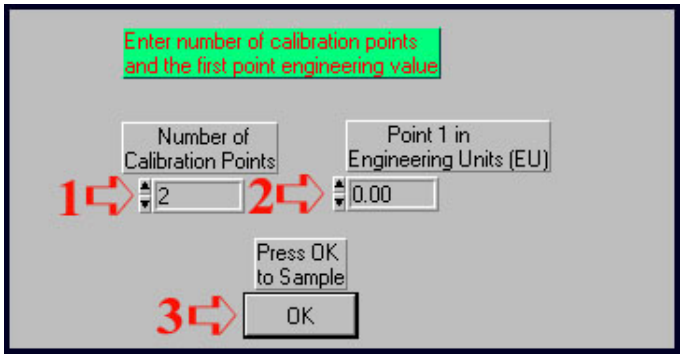

Figure 7
Zero/Span

112 On the “Enter Next Calibration Point in Engineering Units (EU)” screen next to the “Next Point (EU)" header, enter the upper psi value (200, 500, 1000 or 5000 psi) for the range being calibrated.

113 Go into the test cell and place the tube over the tube carrier of Pressure Determination System. See the arrow in Figure 8.

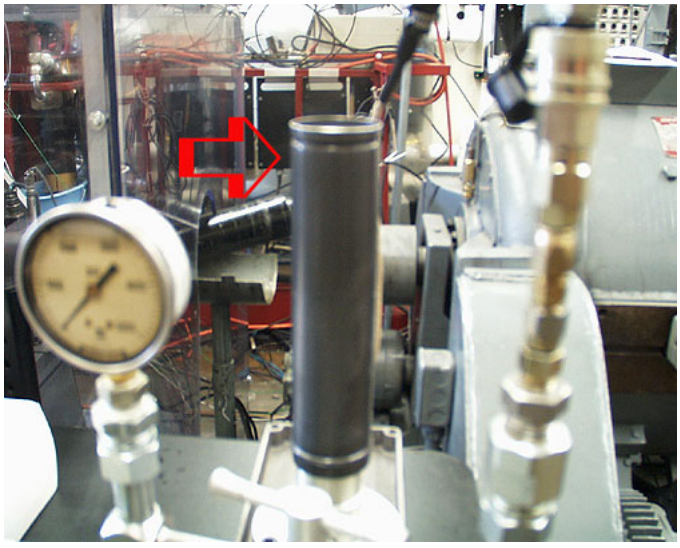

Figure 8
Position Tube

114 Remove the open female snap fitting and connect the pressure transducer/quick-disconnect snap fitting to the pressure determination system. See Figure 9.

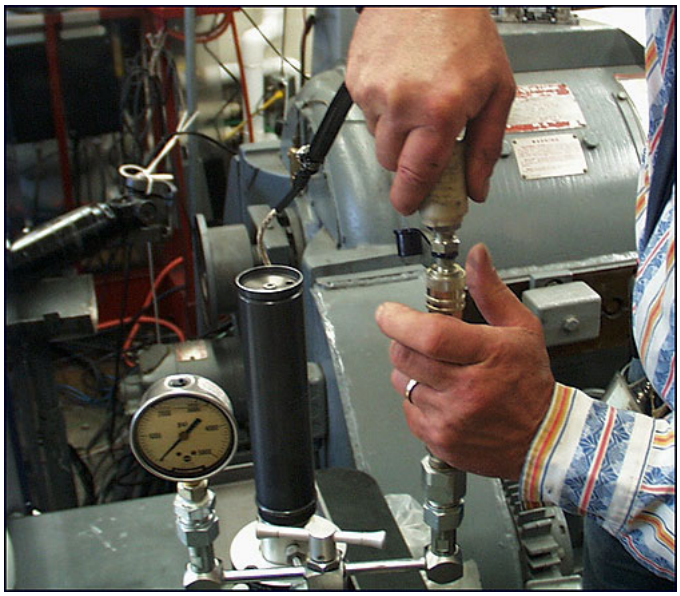

Figure 9
Connect Transducer to the System

115 Do not touch the calibrated weights without first putting on a clean pair of latex gloves to avoid contaminating the weights.

Place the total number of weights listed in the last row of the "Dead-weight Pressure Calibrations" form on the weight carrier tube. The number 26 grooved weight should be placed on the weight carrier tube first. See Figure 10.

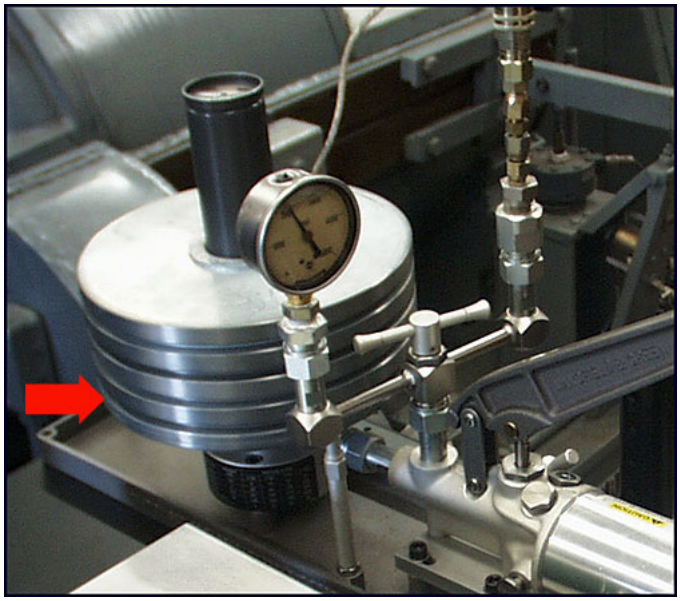

Figure 10
Add Weights

116 Rotate the Pressure Determination System release valve lever clockwise until firmly seated. See the arrow in Figure 11.

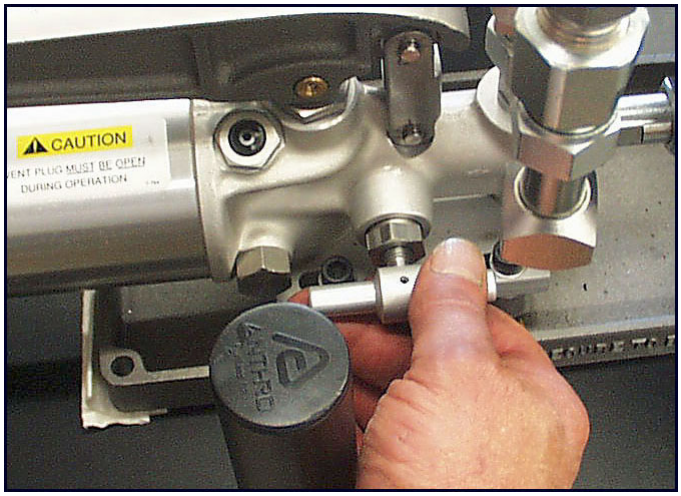

Figure 11
Release Valve Lever

117 Pull the valve rod to the “out” position. The valve rod is located on the left side of the Pressure Determination System. See Figure 12.

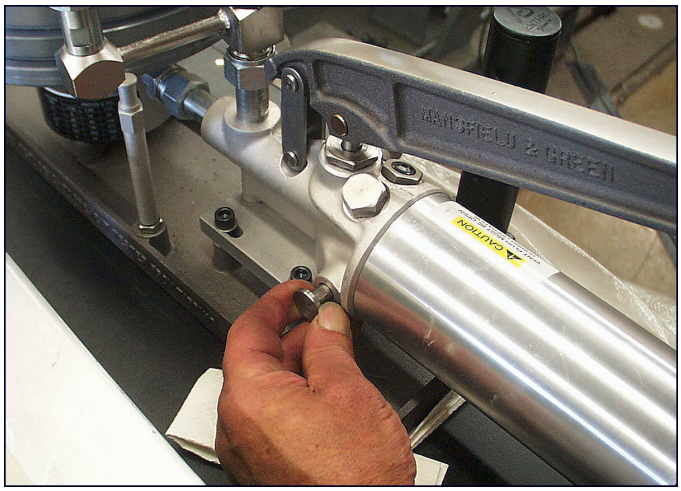

Figure 12
Open Valve Rod

118 Operate the pump handle until sufficient pressure develops to make pumping difficult. See Figure 13.

Figure 13
Hand Pump

119 Push the valve rod in and then operate the pump handle until there is sufficient pressure to allow the tube to rotate freely. Aligning the groove in the bottom weight with the system indicator. See the arrow in Figure14.

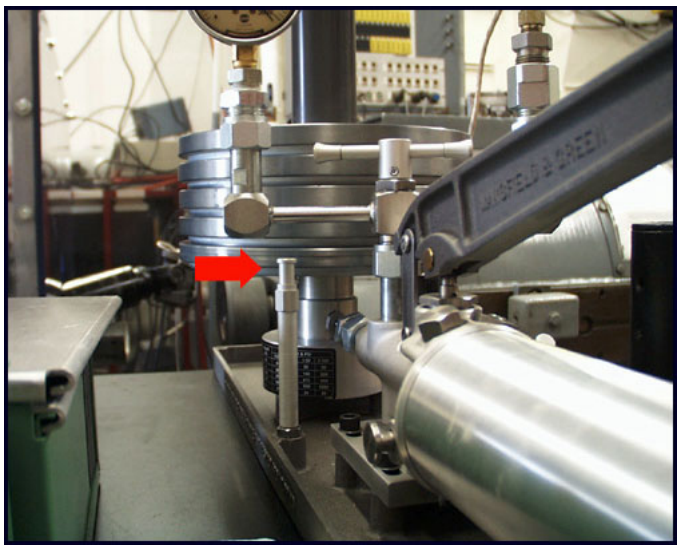

Figure 14
Align Bottom Weight

120 Rotate the weights by hand at 10 to 30 rpm ensuring that the tube spins without wobble.

121 Return to the control room. Select the "OK" button under "Press OK to Sample. See arrow 2 in Figure 15.

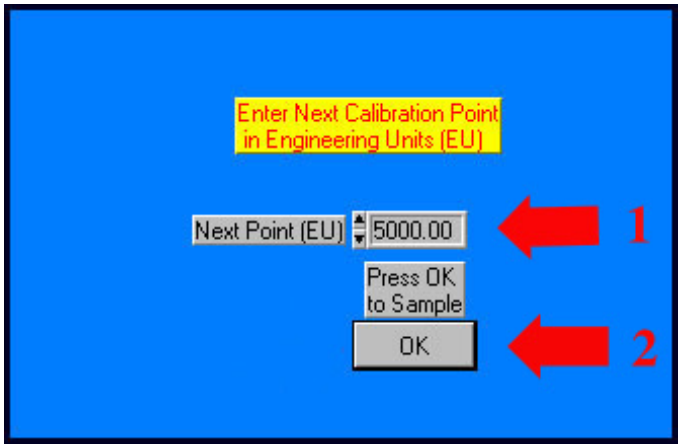

Figure 15
Next Point

122 When the "Do You Want to Save the Coeff." dialog box appears, select "Yes." If you do not wish to save the coefficient, select "No." The program will revert to the previously saved coefficient.

123 On the "Cell 4 Task Master(doc)vi" screen, use the mouse to select the red "Mode Selector" button (see Figure 16a) to change its color from red to blue. See figure 16b.

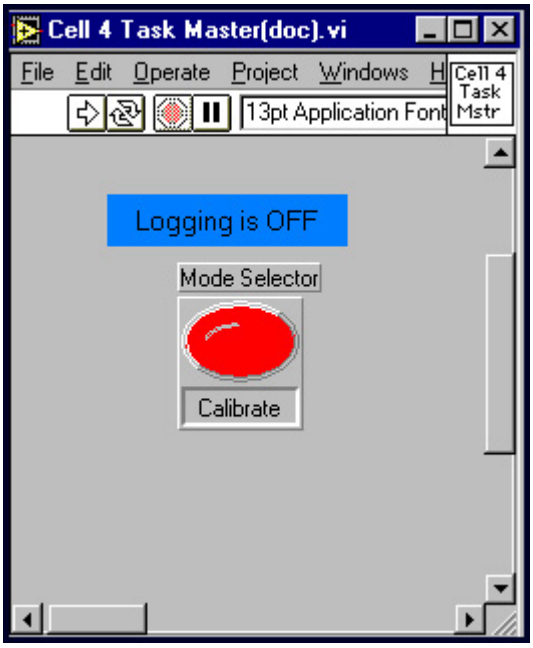

Figure 16a
Mode Selector Calibrate

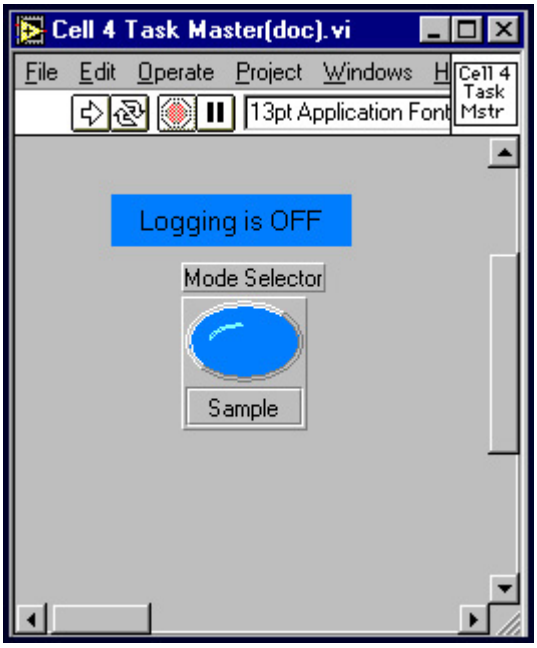

Figure 16b
Mode Selector Sample

124 Select “Single Run.” See Figure 17.

Figure 17
Single Run

125 On the Dead-weight Pressure Calibrations form, record the data in the “Span” row, first “Pressure Transducer Response” column. The “Span” reading should be within +/- 1% of full scale.

126 Return to the test site, relieve the pressure, and disconnect the pressure transducer. Re-attach the quick disconnect snap fitting.

127 Return to the control room and read the pressure in the field corresponding to the pressure transducer being tested:

PortA
PortB
Ch Pump
Control
Case
Accum Press

The Zero reading should be within +/- 1%. See Figure 18

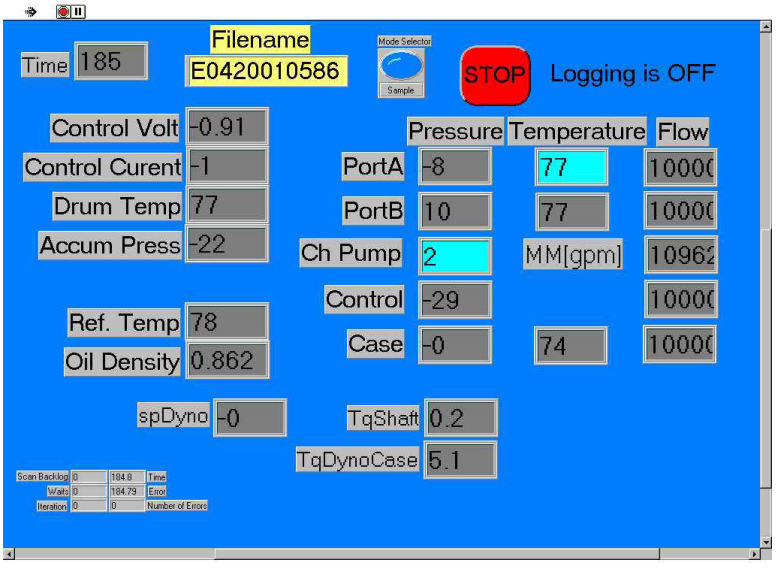

Figure 18
Read Zero & Span

128 On the Dead-weight Pressure Calibrations form, enter the data in the "Atmospheric row, first "Pressure Transducer Response" column.

129 Return to the test site.

Do not touch the calibrated weights without first putting on a clean pair of latex gloves to avoid contaminating the weights.

Remove the weights from the weight carrier tube. Re-attach the pressure transducer. On the weight carrier tube, place the number of weights listed in the next row of the "Dead-weight Pressure Calibrations" form.

130 Repeat Steps 116 through 124.

131 Return to the control room. Read the pressure in the appropriate field.

On the "Dead-weight Pressure Calibrations" form, enter the data in the appropriate row, first "Pressure Transducer Response" column. The reading should be within +/- 1% of full scale.

132 Repeat Steps 128 through 131 using the weight combinations in the succeeding row until all weight combinations listed in the first column have been read and recorded.

133 Starting from the form's bottom row of weight combinations and working upward in the second column under "Pressure Transducer Response, repeat Steps 126 through 128 until all weight combinations listed in the first column have been read and recorded. Compare each with the corresponding first column readings.

3. Acceptance Criteria

3.1 The pressure determination system must be level. A level and shims, if necessary are used to level the system.

3.2 Put on a clean pair of latex gloves before handling the calibrated weights. A weight contaminated when touched with bare hands must be cleaned with an industrial wiping material.

3.3 The groove in the bottom weight must align with the system indicator.

3.4 There must be sufficient pressure to allow the tube to rotate freely when the valve rod is depressed.

3.5 The weights are rotated by hand at 10 to 30 rpm without wobble.

3.6 Pressure readings must be accurate to within +/- 1% of the required value.

Attachment A

Dead-Weight Pressure Calibrations
200 psi Pressure Transducers

						Pressure Transducer Response (psig & voltage)			
				Serial Number					
				Location					
				Date					
		Electrical			Span				
					Read				
Weight Combination Using WG-89 Piston					Dead Weight				
T	23	25	26	27	(psig)				
	Atmospheric				0				
1					5				
1	3				20				
1	3	1			40				
1	3	2			60				
1	3	3			80				
1			1		100				
1		1	1		120				
1		2	1		140				
1		3	1		160				
1		4	1		180				
1			1	1	200				

Note:
Tube (T) = 5 lbs
WG-23 = 5 lbs
WG-25 = 20 lbs
WG-26 = 95 lbs
WG-27 = 100 lbs

Attachment B

Dead-Weight Pressure Calibrations
500 psi Pressure Transducers

						Pressure Transducer Response (psig & voltage)			
				Serial Number					
				Location					
				Date					
		Electrical			Span				
					Read				
Weight Combination Using WG-89 Piston					Dead Weight				
T	23	25	26	27	(psig)				
	Atmospheric				0				
1	1				10				
1	1	2			50				
1			1		100				
1	2	2	1		150				
1			1	1	200				
1	2	2	1	1	250				
1			1	2	300				
1	2	2	1	2	350				
1			1	3	400				
1	2	2	1	3	450				
1			1	4	500				

Note: Tube (T) = 5 lbs
WG-23 = 5 lbs
WG-25 = 20 lbs
WG-26 = 95 lbs
WG-27 = 100 lbs

Attachment C

Dead-Weight Pressure Calibrations
1000 psi Pressure Transducers

						Pressure Transducer Response (psig & voltage)			
				Serial Number					
				Location					
				Date					
		Electrical			Span				
					Read				
Weight Combination Using WG-92 Piston					Dead Weight				
T	23	25	26	27	(psig)				
	Atmospheric				0				
1					50				
1	1				100				
1	3				200				
1	1	1			300				
1	3	1			400				
1	1	2			500				
1	3	2			600				
1	1	3			700				
1	3	3			800				
1	1	4			900				
1	3	4			1000				

Note:
Tube (T) = 50 lbs
WG-23 = 50 lbs
WG-25 = 200 lbs
WG-26 = 950 lbs
WG-27 = 1000 lbs

Attachment D

Dead-Weight Pressure Calibrations
5000 psi Pressure Transducers

						Pressure Transducer Response (psig & voltage)			
				Serial Number					
				Location					
				Date					
		Electrical			Span				
					Read				
Weight Combination Using WG-92 Piston					Dead Weight				
T	23	25	26	27	(psig)				
	Atmospheric				0				
1					50				
1			1		1000				
1	2	2	1		1500				
1			1	1	2000				
1	2	2	1	1	2500				
1			1	2	3000				
1	2	2	1	2	3500				
1			1	3	4000				
1	2	2	1	3	4500				
1			1	4	5000				

Note:

Tube (T) =	50	lbs
WG-23 =	50	lbs
WG-25 =	200	lbs
WG-26 =	950	lbs
WG-27 =	1000	lbs